RANGE
Its Nature and Use

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FOREWORD

This booklet was first prepared by the Society for Range Management, whose aim is to foster advancement in the science and art of grazing land management. The material taken from the original "Range, Its Nature and Use" was modified by Alberta members of the International Mountain Section of the Society to meet the basic needs of the range industry in the province. Since its first printing in 1960, the booklet has been revised seven times. The purpose of the booklet is to increase understanding of the nature and use of grazing lands. Principles of range management are stressed. Some plants and situations referred to may not occur in all regions and, hence, each reader must apply the information to his or her own locality.

1. INTRODUCTION

What Is Range?

Range is an extensive land area, usually not adapted to cultivation, covered with native grasses and other forage plants best suited for grazing by domestic and wild animals. Range may be privately or publicly owned, fenced or unfenced, and may support native or reseeded vegetation. Range has long been thought of only as a home for cattle, sheep, horses and wildlife. However, this may change in the future as an ever-increasing city population seeks new places for recreation, environmental preservation and enjoyment of scenery.

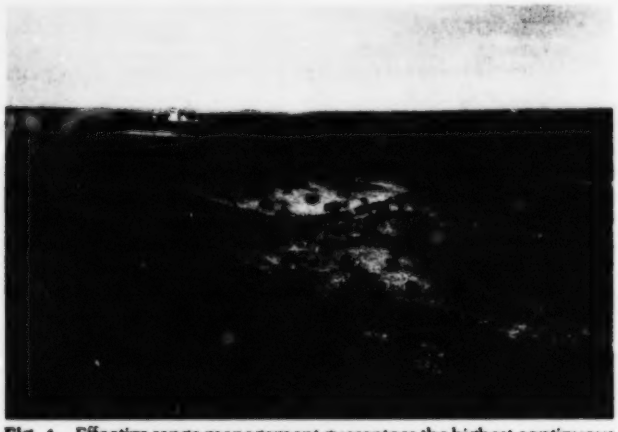


Fig. 1 Effective range management guarantees the highest continuous yield of animal products without endangering the soil and water resources.

Does it Concern Me?

Yes, each of us has an interest in the range since it is a major source of our meat supply. It is important as a source of wool, water, wildlife, timber and many forms of recreation. It is just as important for the non-user of range to promote its conservation and maintenance for future use as it is for the person working and living on it.

What Was the Historical Role of the Range?

Our range is one of the most valuable of our natural resources. It has played a major role in the settlement and prosperity of Western Canada.

No history of the range is complete without a review of the livestock industry, which is a product of the range.

The first cattle and sheep were brought into Western Canada about 1700 through the fur-trading posts on Hudson Bay. By 1812, livestock were present at many trading posts in southern Manitoba and eastern Saskatchewan. Small numbers of livestock reached the Peace River country by 1823, Edmonton by 1840 and Calgary by 1871. Horses, which were first acquired by the Indians of the northern plains about 1730, increased rapidly during the nineteenth century.

Ranching in Alberta started around 1877 when cattle, brought in from Montana, were allowed to overwinter on range near Fort Macleod. The animals were found to be in surprisingly good condition the next spring. The big herds started to move into Alberta in the early 1880s. The Cochrane Ranch Company brought in 6 799 head in 1881 and another 2 600 head in 1882. The Oxley Ranch brought in 3 400 cattle from Montana in 1882.

The early ranchers faced many difficulties, including drought, falling prices and diseases. The severe winters of 1886-87 and 1906-07 were particularly hard on the range herds, with losses of up to 40%. It was a harsh lesson, but it taught cattlemen a lot about the importance of feed reserves.

The period of 1900-25 was one of rapid settlement when much land, suited only for grazing, was broken for grain production. Some of this land was abandoned soon after it was plowed. Abandonment became general during the drought years of the thirties. During this drought period, many native pastures were overgrazed and became covered with weeds. Feed shortages made it necessary to sell much of the livestock. The outlook was bleak.

In the 1940s, with improved moisture conditions, extensive reseeding of abandoned lands was undertaken. Submarginal lands were taken out of grain production and converted to grazing leases and community pastures. Fewer livestock for a time meant that the range had a chance to rest and the better plants increased in numbers. This has been of lasting benefit to the livestock industry.

What Are the Range Resources?

Land uses other than livestock production are becoming increasingly important in the range areas. Recreational use and storage of water are becoming more and more important as the human population increases and the irrigated area is extended. Range use by domestic livestock may have to be curtailed in certain key wildlife areas. At the same time, the demand for meat and other animal products continues to grow. These developments have brought about the need for a closer look at our range resources. The private stockman and the public at large have a real opportunity to plan range use co-operatively.

The poor condition of some of our ranges has contributed to flooding. Much valuable water and soil have been lost, but there is much to be optimistic about. Many ranchers know how to take care of their range — and do take care of it. Government agencies have managed to keep most of the Crown or public rangeland in good, healthy condition. Many thousands of hectares of cropland have been seeded to introduced forages. Production of hay on native meadows and irrigated land has increased fivefold because of improved management. Woodland in the forested areas of the province has been converted to improved pasture to provide additional good quality forage.

How Much Range Do We Have in Alberta?

Alberta is about 66 million hectares or 661 200 square kilometres in extent. About 26 million hectares are considered to be suitable for agriculture, but only 20 million hectares are occupied. Of this area, about 12 million hectares are classed as farmland and about 8 million hectares as rangeland. Public grazing lands are confined to about 3.5 million hectares, administered by the Public Lands Division, Department of Forestry, Lands and Wildlife, held under long-term lease and grazing permits. An additional 1.2 million hectares are administered by the Special Areas Board of the Alberta Department of Municipal Affairs. Special grazing permits are available on about 0.5 million hectares during the summer months in the Forest Reserve. This grazing resource provides about half of the feed requirements for the beef cattle herds.

The largest blocks of grazing land are located in the dry, treeless plains of the southern and eastern parts of the province. About 55 per cent of the rangeland is leased from public agencies and 45 per cent is privately owned (about 3.7 million hectares).

The only public grazing land available for leasing is several million hectares of poplar- and willow-covered land in the northern part of the province. This land does not produce much forage. Clearing, breaking, and seeding of introduced forage crops is, therefore, necessary to increase production and make the growing of livestock economically viable. Clearing and breaking are expensive and may cost over $400 per hectare. Also, summers are short in the northern regions, so it is necessary to provide for a possible seven-month winter feeding period. Despite these limitations, moisture conditions tend to be more favorable than in the south and the supply of forage is somewhat more reliable on improved pasture. Limited grazing allotments are available to established livestock producers in certain central and northern Alberta grazing reserves administered by the Department of Forestry, Lands and Wildlife.

Persons wishing to ranch in the grassland regions of Alberta must arrange to purchase deeded land or to secure the transfer of public lands held under long-term lease or permit.

What is Range Management?

Range management is the care of range to get the optimum sustained use of the forage crop without endangering the soil and water resources and other important uses of the land. Range management and range conservation are one and the same. Grazing management refers to the care and handling of livestock on the range. Four key principles of range management are:

- Balance the number of animals with the forage supply.
- Graze during the proper season or combinations of seasons.
- Keep grazing animals properly distributed over the range.
- Graze the kind or class of livestock that can best use the forage and be the most profitable.

Some goals of range management are to:

- Keep the range covered with good forage plants.
- Maintain a range feed reserve.
- Increase livestock and wildlife products.
- Increase the storage of water in the soil and even out the flow of water in the streams.
- Prevent or control soil erosion on the range watersheds to assure future production.
- Control the proportion of brush cover to grassland.

You can keep the range healthy and productive by understanding how to manage the "community" of plants and animals that live there. If we are going to keep our range cover, wildlife and livestock in balance on a continuing basis, we must consider how many animals should be grazed. If we increase one kind of stock on a range, we may need to reduce another kind to keep within the stocking rate of the pasture.

2. EXAMINING THE THREE COMPONENTS OF A RANGE SITE

To be a successful range manager, you need to know a great deal about soils, water and plants. A range "site" is an area with a special combination of soil type and climate. The nature of the site determines the kind of plants that will grow there. Find out all you can about them. (See the list of Recommended Reading.)

SOIL, THE FRAGILE COMPONENT

Soils are of many kinds. They differ physically in depth, texture and amount of plant matter.

Soil Depth. Soil depth is the amount of soil above the parent material. Soil is made up of different layers but the dark topsoil is the most important to the range manager. It takes about 200 years to build one centimetre of soil from bedrock. Bare topsoil is subject to water and wind erosion, both of which waste its fertility.

Texture. Texture is the physical structure of the soil. It is influenced by the size of the various soil particles within each soil layer. Bedrock first breaks down into large rocks, and then into gravel. As weathering takes place, gravel is broken up into small particles and finally a fine-textured soil is formed. Usually, the richer the soil, the finer the texture. Soil particles have names based upon their size — gravel, sand, silt and clay.

Usually soils are a mixture of particles of various sizes. The name given to a soil is based on the most common particle. For example, in a very fine sandy loam most of the particles are very fine sand, but there are silt and clay particles. Soil particles are grouped together like "grains" of a popcorn ball. Texture sometimes can be determined by feeling the soil with your hands. Color is also used in classifying soils.

Slope. The slope of land can vary from slightly rolling to steep hills and mountainsides. The nature of the slope usually determines the type of range plants that can grow there. Soils on southern slopes warm up sooner than soils on northern slopes. Generally, the steeper the slope, the thinner the soil, and the more rapidly erosion can occur.

Plant Matter. Range plants may become a part of the range soil. Leaves dry and drop to the soil, protecting the surface. Roots die and furnish food for millions of little living plants and animals called soil organisms. Usually, the more organisms there are in the topsoil, the better the range grasses will be.

To keep range soil productive for years to come, we must replace some of the things that have been taken out. At the end of the grazing season, some dry vegetation should be left on the range. This carry-over should be 45% to 50% of the current year's growth.

Carry-over vegetation helps to reduce erosion and to increase water penetration. When grazing animals remove too much of the vegetation, expensive soil conservation practices such as terracing, furrowing, damming and reseeding of grasses are needed to hold the soil in place.

Alberta soils are described in reports of the Alberta Soil Survey. You may be able to obtain a copy of the report for your locality from your District Agriculturist.

WATER, THE LIMITING FACTOR

Water is the most common limitation to production on rangeland. Plants need water for growth. When range plants receive enough water, they grow rapidly and produce plenty of forage for animals. When there is a shortage of water, all plant and animal life suffers.

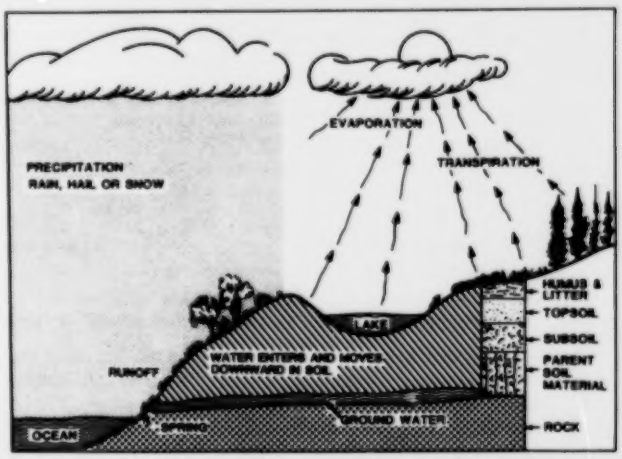


Fig. 2 The natural water cycle — Water that runs off the range too fast may carry off valuable topsoil as well as leave the range plants without moisture.

We want to hold the rain and snow that falls on the range. Part of the rain or melted snow goes into the soil and part runs off. Of the part that enters the soil, some is used up by plants or evaporates, but some moves through the soil and comes out as springs to replenish streams. Water that runs off too fast may carry valuable topsoil with it as well as leave range plants without moisture.

Let's compare a raindrop that hits bare soil with one that falls on grass. A raindrop hitting the soil surface makes a dent and at the same time shatters into fine particles that bounce back into the air, carrying with them fine soil particles. Thus, raindrops falling on bare soil disturb the surface and carry off fine particles of soil. On the other hand, a raindrop that hits a range plant loses its force and trickles into the soil.

Nature "fits" the plants to the range. Range plants, particularly the tall, deep-rooted grasses, are well suited to catching and holding moisture. Grasses have deep root systems. Part of the grass root system dies each year and the dead part is replaced by new roots. When a root dies, it leaves a small channel for water to run into the soil.

PLANTS, THE KEYSTONE OF THE RANGE

Plants tell you what kind of range you have. The presence or absence of certain plants on the range tells how the range has been used and what should be done to improve or maintain it.

As a range manager, you will need to know range plants by their standard common names. Hundreds of different plants are found on a range. However, you only need to know those that furnish the most livestock forage or are poisonous to livestock. In general, about 10 to 25 plants in any one range area will be important. You need to know how to manage them to produce the most livestock and livestock products.

Four Range Plant Groups

Range plants differ greatly in form and life habit. They are commonly grouped into four main types: grasses, grasslike plants, forbs and shrubs.

Grasses have hollow, jointed stems and leaves in two rows on the stems. Veins in the leaves are parallel. These are "true grasses" and are the most important plants on the range. Examples are western wheatgrass (a perennial with creeping underground stems or rhizomes), rough fescue (a perennial bunch grass) and cheatgrass brome (an annual grass).

Grasslike plants look like grasses but have solid (not hollow) stems with no joints and are often triangular or round in cross-section. Veins in the leaves are parallel. These plants are sedges and rushes. Examples are threadleaf sedge (black fibrous roots), baltic rush (creeping rhizomes) and prairie bullrush (three-cornered stems).

Forbs are broadleaved plants with annual stems (tops). The veins in the leaves are usually, but not always, netlike. Many forbs are valuable as forage. Examples are peavine (a legume with wide leaves), vetch (a legume with narrow leaves) and geranium (hairy stems).

Shrubs are woody perennial plants with stems that live over the winter and branch from near the base. Examples are winterfat (white hairy seeds), shrubby cinquefoil (bright yellow flowers), and choke cherry (reddish berries). Trees are shrub-like in growth form but have a definite trunk with branches well above the ground.

Each group contains many individual plants. You should learn the names of the important ones. The botanist uses a plant key to identify each one, but most people have trouble using such a key. An illustrated guide to some common range plants of Alberta is given in the bulletin, *111 Range and Forage Plants of the Canadian Prairies*. It may be more practical for you to take the plants you wish to have identified to a range specialist, teacher or District Agriculturist. Some illustrated books, for example, *Wild Flowers of Alberta*, are useful aids in identification.

The drawings in Figures 3 and 4 will help you to recognize and understand the four groups of plants when you read their descriptions.

The best way to know plants is to collect, mount and name them. This is an excellent project for a 4-H Club or a person who wishes to become proficient in range management. The 4-H Club leader, teacher or range specialist can show you how to make a collection. (See the publication *Range Management*).

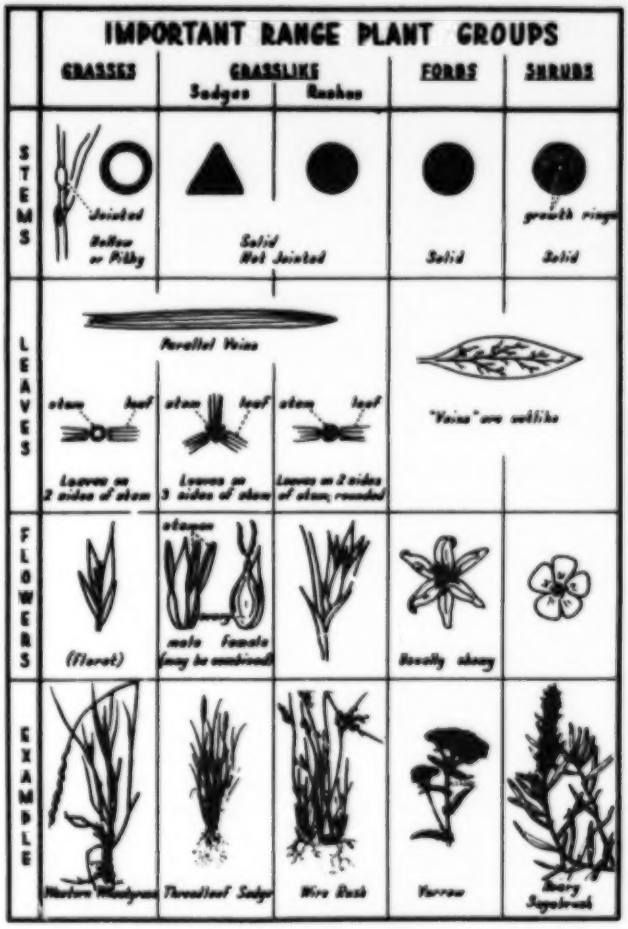


Fig. 3 Important range plant groups.

Forage Values

The forage value of each species can be determined by its palatability (how well livestock like it), nutritive content and dependability as a forage supply. The forage value is a relative factor and may vary, depending on the kind of livestock, other plants present, the soil fertility and the season. Forages are classed as good, fair or poor.

Cattle like to graze grass that is high enough to let them "wrap their tongues around it" and get a big bite. Early in the spring, the tall grasses are soft and the livestock like them. Cattle that are forced to eat the short grasses get less to eat and gain less. Cattle also eat some forbs and shrubs.

Sheep are browsers. They like fine grasses and will eat forbs and shrubs more readily than cattle will.

Poisonous Plants

Poisonous range plants that kill livestock often reduce ranchers' income. Some range plants are poisonous only at certain stages of growth and seasons but provide good forage at other times. The rancher must know these plants.

Here are some aids to help you to prevent stock poisoning:

- Know the poisonous plants.
- Do not overuse the range forage.
- Graze only at the proper season.
- Be careful with hungry animals.
- Provide ample salt and needed mineral supplements.
- Use a class of stock not poisoned by the plant present.

These plants have killed livestock on Alberta ranges:

Tall larkspur. Our most serious poisonous plant. Found in the mountains, foothills and northern forests. A tall-growing species (50 to 150 centimetres) with showy spikes of blue, spurred flowers. Rarely affects sheep or horses but is very poisonous to cattle.

Low larkspur. Found in the Cypress Hills, Milk River Ridge, foothills and high prairie country. Is less poisonous than tall larkspur. Grows from 15 to 50 centimetres high and has dark blue, spurred flowers.

Arrowgrass. Found on wet saline soils and marshes throughout the prairies. Looks like a grass but has spongy leaves that are round on one side. Poisoning is caused by hydrocyanic acid.

Death camas. Found in draws, moist hillsides and along edges of grassy sloughs throughout the foothills and prairie. Grows from a bulb and has clusters of cream-colored flowers. Poisonous to both sheep and cattle.

Water hemlock. Found by springs and in freshwater marshes. Often confused with water parsnip, cow parsnip or angelica.

Injurious Plants

Many range plants are mechanically injurious to animals at various times of the year. Plants of the cactus family injure grazing animals when the spines pierce the skin. Needlegrasses injure sheep when the seed is mature and begins to shed. Once the needlegrass seed gets a hold in the wool, it works its way through it and into the skin. This damages the flesh for edible food and makes the hide useless for leather. At earlier stages of growth, needlegrasses furnish good quality forage to grazing animals.

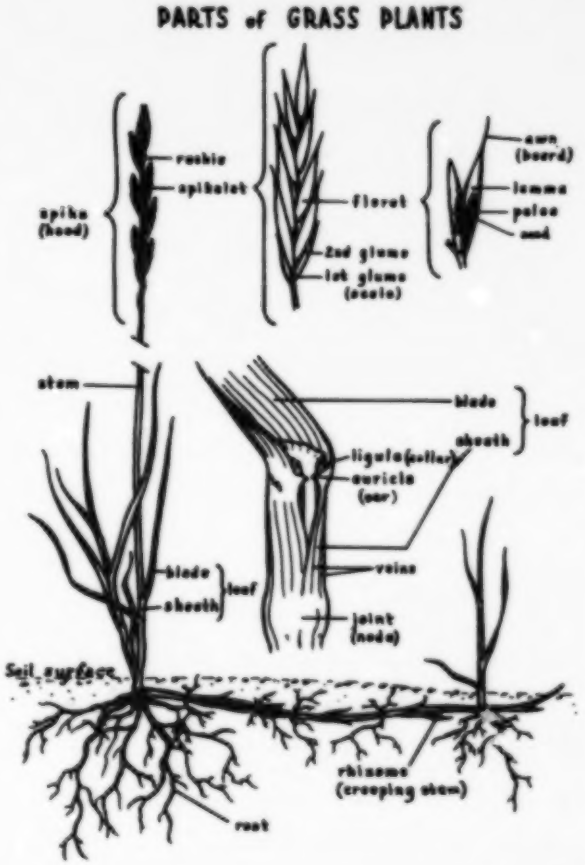


Fig. 4 Parts of a grass plant — True grasses are the most important plants on the range.

3. UNDERSTANDING THE DYNAMICS OF A RANGE

PLANTS AS FOOD FACTORIES

Range plants are living organisms. They need food, air, water and light to live and grow. If one of these items is cut off, the plant will die. Each year, most of our range plants produce seed that may sprout and become mature plants.

A green grass plant is nature's food factory. The sun supplies the energy required. Water, air and minerals are the raw materials the plant uses in manufacturing its food. Some finished products are sugar (an energy food) and protein (needed for growth). The waste products are oxygen, carbon dioxide and water. Let us follow, step by step, the materials used by the grass plants.

Water

Water makes up about 70% to 90% of the weight of green grass and from 8% to 25% of dry grass. The plant uses some of it directly to "keep cool." Much of the water serves to carry food and minerals within the plant's body.

Most of the water is absorbed through the roots, although a small amount is taken in by the leaves. The young tender leaves contain more water and nutrients than any other part of the plant. Grasses, like other plants, need large amounts of water to produce one kilogram of dry forage. In semi-arid areas, range grasses need from 300 to 1 000 kilograms of water to produce one kilogram of dry forage, while shrubs and trees need 1 700 to 2 400 kilograms to produce one kilogram of twigs, bark and leaves.

Air

The grass plant takes in carbon dioxide through stomata (microscopic pores) on the underside of the leaves. Inside the plant cells, the carbon dioxide, with other raw materials, is made into starches, sugars, fats and protein that animals need. When the plant is fully grown and green, it manufactures more food and building materials than it needs. This extra material is stored in the stem, crown and roots to carry the plant over the winter and for regrowth next spring.

Nitrogen is another element that the grass plants need. However, it is in a free state while in the air and cannot be used by the grass plants until it is combined with other elements. Plants obtain most nitrogen from the soil.

Elements

As many as 36 elements have been found in plants. Sixteen of them are essential for grass growth. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, boron, manganese, copper, zinc, molybdenum and chlorine. Each of these elements has a definite place in the life cycle of a grass plant.

Remember, the green tops or herbage of plants manufacture the food and building materials for the roots and tops. If the tops of the plants are eaten off, they cannot manufacture food.

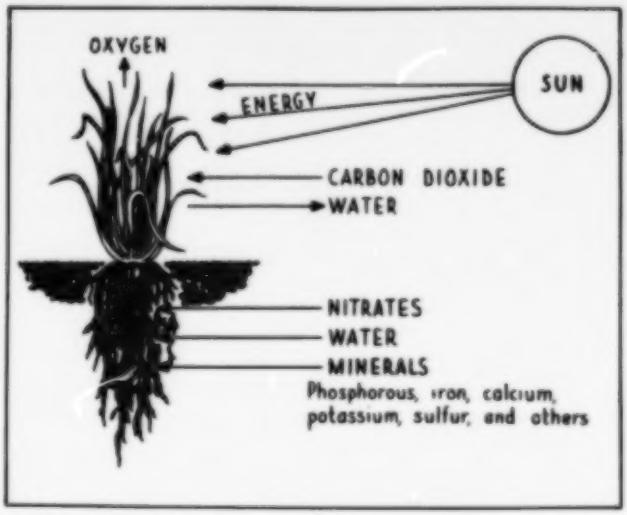


Fig. 5 Vegetation is the producer in an ecosystem. It uses sunlight for energy and converts it to food for animals.

GRASS, THE RENEWABLE RESOURCE

It is important to know the grasses and how they grow in order to understand the basis for range management.

Grass species are either annual or perennial. Annual grasses grow from seed and die all in one year. Most of our grasses are perennial. Perennial grasses live for more than two years and stay alive during winter or through a summer drought by becoming dormant.

Perennial grass plants can reproduce from seed or from underground stems called rhizomes. The above-ground parts of the plant, which grow from seeds or rhizomes, are called tillers. The first tiller to appear is the parent tiller while the new tillers are referred to as secondary tillers. Tillering is most important in order for perennial plants to continue growing after being dormant.

Each tiller consists of a stem which, like the stem of a tree, has leaves growing from it. Stems can be very short, with leaves that seem to be growing from the ground, or they can be long with leaves spread widely along their length.

Both vegetative and reproductive tillers can be found on the same plant. Vegetative tillers have only leaves while reproductive tillers have both leaves and flowers. The flowers are always found above the leaves on the stem. In most grasses the tillers must first go through a vegetative stage before they can become reproductive. The change from vegetative to reproductive tillers is controlled by genetic and environmental factors.

All leaves grow from a node on the stem and the node can be easily seen on long stems. The portion between the nodes is called the internode. The internode may be 10 centimetres or more in length on long stems but may not be distinguishable on short stems because the nodes are crowded on top of each other. Reproductive tillers usually have long stems.

Grass Growth and Its Response to Grazing

When a tiller grows and produces leaves, it also produces buds in the axils of the leaves. The axil is at the base of the leaf on the stem. When these buds, known as axillary buds, begins to grow, the cells divide very rapidly, particularly near the top. The area where cells are rapidly dividing at the top is called the growing point. The growing point forms

new buds from which leaves will grow and some may develop into flowering stems. These new buds appear to be stacked on top of one another so that the oldest bud is nearest to the bottom and the newest bud is nearest to the top of the new tiller. The leaves will also appear first from the oldest bud so that in a tiller, whether long or short, the oldest leaves are at the bottom while the newest leaves are at the top of the plant.

The growing point controls the growth of secondary axillary buds by producing a hormone that prevents the buds from growing. If the growing point is removed, then all growth of that tiller will stop and new growth can only come from the secondary axillary buds of that tiller.

The position of the growing point is very important in determining the plant's response to grazing. An elevated growing point removed by grazing will result in stoppage of growth or delayed production from that plant. Where the growing point is near the ground, it will escape grazing and be in a position to continue producing leaves and to maintain a positive energy balance. A plant that can only grow new leaves from new tillers will have to spend energy on growth before it can again put energy into storage in the roots and stems in order to keep itself healthy.

RANGE AS ONE ECOSYSTEM

A better understanding of the range may be obtained when we consider plants and animals as forming a community. This is the basis of the concept of the range ecosystem. The range ecosystem involves the interrelationships among plants, animals, soil, water and climate. It is a complex system that includes both living organisms and the non-living environment and is concerned mainly with energy flow and nutrient cycling.

Vegetation contributes to energy flow and nutrient cycling. Plants use sunlight for energy and convert it to food for animals. Nutrients for plant growth are obtained from the soil. The soil acts as a bridge between the living and the non-living portions of the ecosystem. The vegetation is the producer in an ecosystem. Therefore, the number of livestock or wildlife that the range will support depends on the ability of plants to fix the sun's energy through photosynthesis.

Grazing animals consume the vegetation and help cycle the nutrients into the soil. They return a large proportion of the consumed plant nutrients to the soil. Without grazing animals, the minerals cycle from soil to plants, to litter, and back to soil. Grazing animals are the consumers in an ecosystem. Primary consumers, such as livestock and some wildlife, insects and birds, live directly off plants. Secondary consumers, which eat the primary consumers, are represented in the ecosystem by animals such as snakes, wolves, coyotes, eagles and hawks.

Organisms that attack producers and consumers play an important role in an ecosystem. These organisms break down the bodies of producers and consumers. They are called decomposers. They include bacteria and fungi. Decomposers cycle the minerals and organic matter, thus maintaining soil fertility. The nutrients released by decomposers are made available to other plants.

The balance in an ecosystem can be easily upset. This may be accomplished by manipulators or organisms that deliberately rearrange the factors of the range ecosystem for their own benefit. Man, the master manipulator, can change the stability of an ecosystem through management or cultural techniques. Other manipulators, such as bees, ants and beavers, can also alter the ecosystem. An action on one part of the ecosystem, for example the introduction of a new plant, affects the entire system. In range management, however, manipulation to speed up or retard the rate of decomposition may be desirable in certain circumstances.

Vegetation plays an important role in ecosystem regulation. The greater the variety of living things, including range vegetation, the more stable the ecosystem will be. With a diversity of species, there are alternative pathways for energy flow.

In the range ecosystem, light energy from the sun is reduced by plants during photosynthesis; thus the energy flow is gradually lost. The level of nutrients remains fairly constant as they are continuously cycled throughout the system.

RANGELAND PLANT COMMUNITIES

Plant communities are composed of four main types of plants: grasses, forbs, shrubs and grasslike plants. These plants are constantly competing for sunlight, water and soil nutrients. This struggle never ceases and the strongest, best-adapted plants dominate the range.

The conditions under which plants grow also change. The plant that is best adapted on a protected site may not be best adapted if the area is grazed. Many of our range plants are weakened by heavy grazing.

Plant Community Change

The plant community is never stable. It is always changing for better or worse. Let us consider a tall grass community and see what changes take place during a long drought and continued heavy grazing use.

Tall-growing grasses are usually deeper-rooted and require more water to live than the short-growing grasses. They will keep the short grasses out. During a long drought the tall grasses will be weakened. Parts of them die, leaving room for short grasses to move in. The same thing happens with heavy grazing; only now, the tall grasses are weakened by grazing while the short grasses escape. If drought and heavy use continue, the short grasses in turn are replaced by forbs and unpalatable shrubs. The better, hard-working, range plants are thus replaced by poorer, lazy plants that produce little livestock feed. Range in such condition is a poor home for grazing animals.

The grass community is a desirable one to have on a range. Grasses are good conservers of water and soil and they are good forage producers. Under natural conditions, the prairie range is made up of a few short-growing grasses mixed with tall-growing grasses. In range that is in top condition, known as climax range, a natural set of plants is in balance with the environment. It is a "healthy" range.

A plant that is grazed and then allowed to grow again will not be seriously hurt. But, if the tillers are kept grazed close to the ground surface, the plant suffers. Where the tillers are kept down, root growth is restricted. The grass plant is then less able to compete for moisture and nutrients with the ungrazed, unpalatable plants around it.

If all plants are grazed to the same height, the short-growing ones will still have the advantage over the tall-growing ones. Here is the reason. Suppose we have a tall and a short grass growing side by side. If both were grazed down to the same height, say five centimetres, the short grass would lose only one-quarter of its top growth, but the tall grass grazed to the same height would lose over three-quarters of its top growth. It is easy to see that the tall grass would be crowded out because its food-making machinery — the upper part of the plant — is reduced too much to work well.

For good range management, enough tillers should be left each year so that the grass can manufacture its own food and build strong roots. Food is stored in the roots and crowns for early growth next spring, but only after the grass plant makes a seed head.

Fig. 6 Rough fescue plants have been clipped to simulate no grazing, moderate grazing, heavy grazing and very heavy grazing. In 20 weeks, the moderately grazed plant produced nine times as much top and 12 times as much root as the very heavily grazed plant.

Plant Communities in Top Condition

It takes thousands of years to produce a fertile soil and a productive grass community. A plant cover that makes the best use of soil nutrients, soil moisture and the energy of the sun is called a "climax" plant community. Climax, or original vegetation, is the highest form that nature can produce. In the foothills, a stand of rough fescue with a mixture of shorter grasses, a few forbs and very few shrubs make up the climax stand. Range in "top" condition is in the climax or near-climax stage and produces the highest yield of forage. Overgrazing causes it to deteriorate into a "sub-climax" stand.

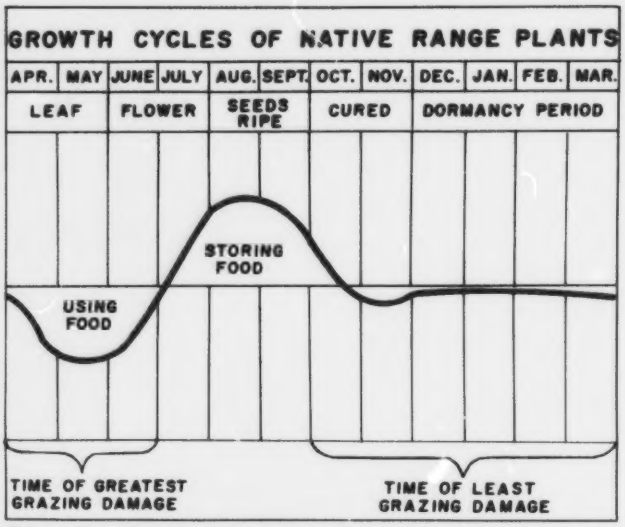


Fig. 7 Growth cycles of native range plants — For good range management, a plant must be grazed leaving enough shoots behind to allow it to manufacture its own food and build strong roots.

PLANT COMMUNITIES AND GRAZING RESPONSE

Range plants are grouped according to their response to grazing. These groups are called decreasers, increasers and invaders. They are indicators of range condition.

Decreaser plants are the most desirable as they are the tallest and most productive of the range plants. When decreaser plants are abundant on your range you know that your grazing program is going well. Decreaser plants are plentiful in climax range but are the first to decrease as grazing becomes heavy. The poorer the condition of the range, the fewer decreaser plants will there be.

Increaser plants are also native plants of the climax range, but are less palatable and often less productive. Many are short stemmed. They escape grazing because they are short or because they are less tasty to livestock. Increaser plants are the ones to watch with caution. They increase in numbers as grazing becomes heavy. They replace decreaser plants that are weakened by overgrazing.

The manager must use caution if there is a change in the number of increaser plants on the range. If range deterioration continues, the increaser group plants will weaken and die out. At this time plants not originally a part of the plant community will move in to occupy the available space. When this happens, the manager must make drastic changes in the grazing program.

Invader plants are the plants that invade and take over a range as the decreaser and increaser plants die. Invader plants are absent in climax vegetation or are present in very small amounts only.

By observing changes in the plants on the range, a careful operator can determine changes in range condition. If there are large quantities of decreaser plants present, the range is in a healthy condition. If increaser plants are found in large quantities, a serious problem could be developing.

We need to learn to judge range health, and how to keep the range healthy, by knowing the decreaser, increaser and invader group plants. A list of the most common species grouped as decreaser, increaser or invader is given in the appendix.

4. STOCKING YOUR RANGE FOR OPTIMUM USE

JUDGING RANGE CONDITION

Range condition is range "health." Range condition shows what has taken place in the past. One method of judging range condition is by the amount of native climax plants on grassland ranges. The greater the proportion of forage provided by the climax grasses and other plants, the better the range condition.

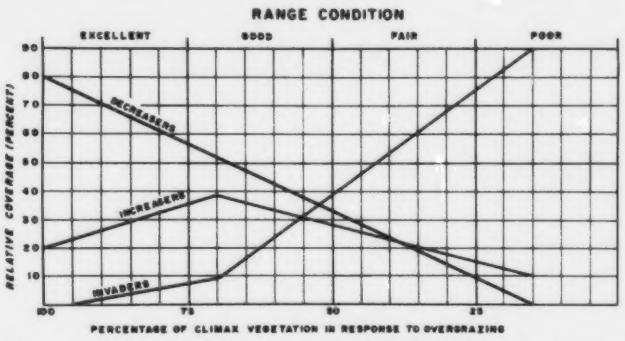


Fig. 8 Relation of decreasers, increasers and invaders on rangelands.

Range Condition Classes

Since all range sites are not in the same condition, we separate them into standard classes. By knowing range condition classes, you will know how to manage your range better.

The standard range classes are:

Excellent condition range exists when forage yield from climax (decreaser and increaser) plants is 75% to 100%. Heavy mulch is present, rain soaks in rapidly and there is no erosion.

Good condition range exists when forage yield from climax plants is 50% to 75%. The ground is covered with vegetation, the plants are vigorous and erosion is slight.

Fair condition range exists when forage yield from climax plants is 25% to 50%. Increaser plants produce most of the forage. Climax grasses are in a weakened condition. Perennial forbs and shrubs and some annual grasses are present and forbs are numerous. The ground is not completely covered. Production is low, water penetration is poor and water run-off is large.

Poor condition range exists when forage yield from climax plants is 0% to 25%. The amounts of annual grasses are large. Forbs and shrubs have become vigorous and abundant. The soil is poorly protected, soil fertility is low, topsoil is hard and dry and loss of water from run-off is considerable.

The kinds of plants on the range can tell the story of various influences, such as the amount of water and the amount and time of grazing, better than any mechanical device. Plant growth best portrays the condition of the soil and how the range is grazed.

There are certain things to look for when judging range condition. "Excellent" range condition is the ideal. The farther a range departs from the ideal, the lower you place it in the scale of standard classes. "Excellent" range is best able to use and conserve the available moisture, the soil fertility and the available sunlight. It has the most productive set of plants possible on a piece of range.

"Excellent," "good," "fair" and "poor" condition range on ordinary upland range sites in southwestern Alberta are shown in Figures 9, 10, 11 and 12.

Fig. 9 Range in excellent condition with a high percentage of decreaser plants.

Range Sites

Soil and climatic conditions of range areas differ. We would not expect to find the same set of climax plants on clay flats as on rocky slopes. Each range site is a special combination of soil type, slope and climate.

The climax vegetation on each site also differs. Each site must be judged separately. The stocking rate of each site in a pasture also must be calculated separately (and added together) to get the proper stocking rate for the whole pasture.

Range Condition Score Card

The Alberta Forest Service uses a score card for assessing range condition in the forest area. The higher the score, the better the range condition. The score card is based on four important factors: (1) soil condition, (2) plant density or cover, (3) plant composition and (4) plant vigor. In assessing range condition, all four factors should be considered together. Range should not be judged on the basis of one factor alone. A summary of the score card follows:

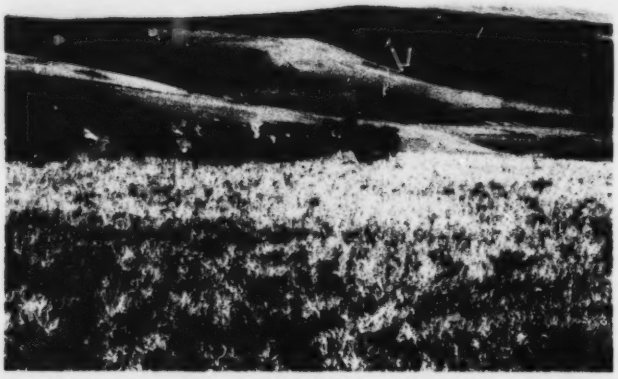


Fig. 10 Range in good condition has plants that are vigorous, and erosion is slight.

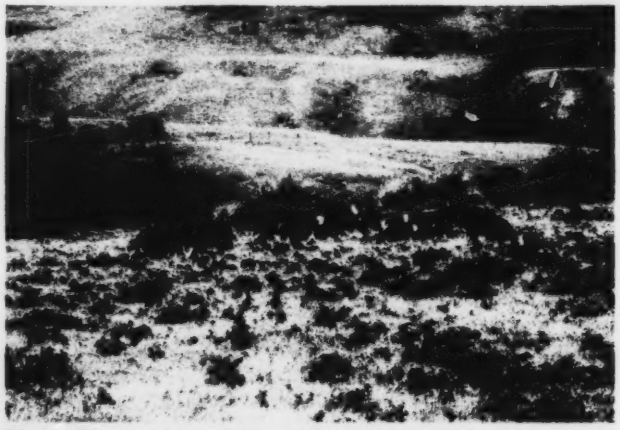


Fig. 11 Range in fair condition has numerous forbs.

Class 1 has 0% to 20% bare ground with no soil loss or erosion; plant density is 45% or over; the better perennial herbaceous forage plants are abundant; and palatable plants are vigorous.

Class 2 has 20% to 40% bare ground with slight soil movement that is difficult to recognize; plant density is 30% to 45%; the better perennial forage plants are moderately abundant; and palatable plants show some vigor.

Class 3 has 40% to 60% bare ground with soil movement or loss that is more noticeable; plant density is 15% to 30%; the better perennial forage plants are scarce; and palatable plants lack vigor.

Class 4 has over 60% bare ground with soil movement and loss that is readily recognizable; plant density is less than 15%; the better perennial forage plants occur only as relicts; and the palatable plants are sickly and weak.

Fig. 12 Range in poor condition not only has low forage yield, but the soil is poorly protected.

Range Condition Guides

Range condition guides have been developed for the grazing lands of Alberta. The *Guide to Range Condition and Stocking Rates for Alberta* and *Alberta Range Pastures* (listed in the Recommended Reading) are examples of such guides. By using these guides, you can rate the condition of your range.

To rate a tract of range, you will make a list of the kinds and amounts of plants that grow on it. You use this list with the range condition guide. The list tells you how much of each increaser plants are allowed to count towards range condition. The total amount of the decreaser plants and the allowable increaser plants give you a range condition score. The amounts of invader plants are not included in the tally. The range condition score provides a guide to the deviation from climax when rated in the excellent, good, fair or poor range condition class.

When you have the score for a piece of range, you are ready to calculate the stocking rate. Suggested stocking rates for a given range condition class in a particular precipitation zone are shown in the range condition guide.

STOCKING THE RANGE

It is important that a rancher or range manager make a good estimate of range condition and then stock the land at the proper rate. Understocking fails to make full use of the range. Overstocking for a few years may bring in a little extra money, but the range may be so damaged that production will be low for many years to come. If topsoil has been lost, the land will not return to its original productivity in your lifetime.

If your land has been abused so that the condition has deteriorated, it must be stocked lightly so that it can improve. Stocking rates must also be reduced for such unfavorable conditions as drought, late spring or grasshopper damage.

Stocking Terms

There are several terms that apply to grazing capacity. The following terms and equivalents are used:

Animal Unit (AU) — a 450-kilogram (1 000 lb.) cow, with or without an unweaned calf at side, or equivalent.

Animal Unit Month (AUM) — the grazing required to support an animal unit for one month.

Animal-Unit Equivalents

1 weaned calf	1/2 AU
1 yearling steer or heifer	2/3 AU
1 cow, with or without calf	1 AU
1 bull	1 1/3 AU
1 horse	1 1/3 AU
1 elk	3/4 AU
5 ewes	1 AU
5 deer	1 AU
10 antelope	1 AU

Stocking rate can be expressed as the number of hectares required to support one animal unit for one month. Stocking rate can also be expressed in animal unit months per hectare. However, the hectares per AUM are easily converted to hectares required to support an animal unit for one year, a value often used on public grazing lands.

Grazing Capacity Zones

The grazing areas of Alberta can be divided into six grazing capacity zones:

Zone 1: the needle-and-thread/blue grama prairie; average stocking rate 1.7 hectares per AUM.

Zone 2: the needle-and-thread/blue grama/wheatgrass prairie; average stocking rate 1.4 hectares per AUM.

Zone 3: the western porcupine grass/wheatgrass prairie; average stocking rate 1.0 hectare per AUM.

Zone 4: the rough fescue prairie (foothills); average stocking rate 0.7 hectares per AUM.

Zone 5: the parkland (a mosaic of grassland and aspen groves); average stocking rate 1.3 hectares per AUM.

Zone 6: the bush pastures; average stocking rate 2.0 hectares per AUM.

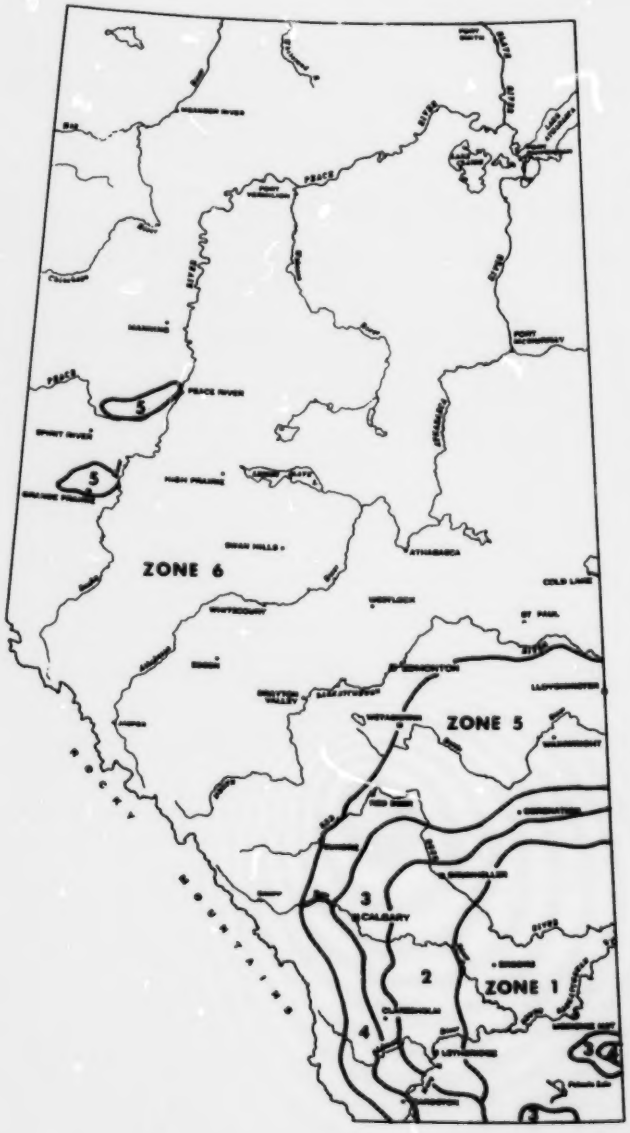


Fig. 13 Alberta grazing capacity zones.

Stocking Rates

The table below shows the stocking rates in the various grazing zones of Alberta at the four standard classes of range condition. Keep in mind that the values for stocking rates in the grazing zones apply to average sites in average condition. There is considerable variation within each zone depending upon soil, slope, range condition and, in the wooded areas, density of tree cover.

Alberta Stocking Rate Guide

		Stocking Rate (hectares per AUM)			
Zone	Vegetation	Excellent Condition	Good Condition	Fair Condition	Poor Condition
1	Needle-and-thread/ blue grama	1.3-1.5	1.6-1.8	2.0-2.2	2.6-3.4
2	Needle-and-thread/ blue grama/wheat-grass	1.0-1.2	1.3-1.5	1.6-1.8	2.4-2.6
3	Western porcupine grass/wheatgrass	0.7-0.9	0.9-1.1	1.2-1.4	1.6-1.8
4	Rough fescue (foothills)	0.4-0.6	0.6-0.8	0.8-1.2	1.2-1.4
5	Parkland	1.0-1.2	1.2-1.4	1.5-1.9	2.0-2.7
6	Bush pastures	1.5-1.7	1.9-2.1	2.2-2.6	2.8-4.0

ESTIMATING THE PROPER STOCKING RATE

You can use the stocking rate guide to estimate the grazing capacity of your range. Let us take a specific example and follow it through the table.

Suppose your land is in the foothills zone (Zone 4). A careful examination indicates that site quality is above average. A high percentage of decreaser plants puts it in the "good" condition class. Suppose also that you use it for five summer months.

Find Zone 4 in the first column of the table, follow across to the value in the "good" condition column and read 0.6 to 0.8 hectares per AUM. Since your land is above average in quality you select the lower area requirement of 0.6 hectares per AUM. This figure is the index for stocking rate. If you have 240 hectares of this range, you would determine its capacity in animal unit months by dividing this area by the stocking requirement (240 ÷ 0.6 = 400 AUM).

To get the number of animal units that you can safely graze (stocking rate) for five months, you would divide the animal unit months by the number of months (400 ÷ 5 = 80). If yearlings are to be grazed, you can calculate the stocking rate by dividing the number of animal units for five months by 2/3 (1 yearling = 2/3 AU). This equals 120 yearlings for five months.

Measuring Range Forage Production

Another way to estimate stocking rate is based upon direct measurement of the forage produced by clipping and weighing. The method might be a good demonstration project for a club tour or meeting.

Mark off a circle on the ground using two large nails and a piece of string with a loop for one nail at each end. The loops must be spaced 56 centimetres apart. Within this circle, an area of one metre square, clip the forage to ground level. Weigh the air-dried forage on a gram scale. By multiplying the weight in grams by 10, you obtain the weight of forage in kilograms per hectare. Thus, if the forage in one circle weighed 85 grams, there would be 85 × 10 = 850 kilograms of forage on one hectare.

To find out how long a cow could graze one hectare that had 850 kilograms of forage, multiply this figure by 0.5 (850 × 0.5 = 425 kilograms). Grazing half and leaving half is proper use of grass. Since a cow needs 14 kilograms of grass a day, you divide 14 into 425 to obtain 30, the number of days to let one cow graze on one hectare. On a basis of year-long stocking, the cow would need 12 hectares (365 days divided by 30 equals 12 hectares). On the same basis as the table, the stocking rate would be 1.0 hectare per animal unit month.

The Range Condition Method

By far the most accurate way to determine stocking rate is to stock the range according to your best estimate and see what effect this has on the vegetation of key range areas. This method takes a long time. The estimate is usually based on one of the previously described methods. Then, after stocking at the estimated rate, the decreaser and increaser range plants are carefully watched to see how they react. Further adjustments are made from time to time until the greatest use is being made without permanent damage to the important plants. This is the "range condition" method.

If you wish to be sure about your judgment, it is best to set up permanent markers in the range. These permanent markers should be checked every year or two to determine accurately whether the range is improving or going down in condition. This might require the help of a range specialist.

ADJUSTING THE GRAZING LOAD

Not all grazing animals use the various kinds of range plants to the same extent. The amount of each grass, forb and shrub that can be grazed without harmful effects to the plant is limited.

Categories of Range Use

Range utilization is the amount of forage removed from a range area by grazing animals. There are three categories of utilization.

Heavy use leads to a decrease in forage production and range condition. Heavy use is harmful to plants, soil and animals. With heavy use, grasses are grazed short and no seed heads are produced; the roots shrink in size and length and, in a drought, the plants die. Heavy use results in unprofitable returns, excessive trampling and accelerated water and wind erosion. Grasses that are kept grazed short require three to four weeks of top growth before root growth begins.

Light use means not grazing the area enough. It is not economical. Valuable forage is not used. When grasses are left ungrazed too long, fire hazards develop and the thick litter smothers early spring growth.

Moderate use, or proper use, ensures protection of the soil and forage and gives highest productivity. Proper use for most grasses means that about 50% of the total weight of the above-ground parts of the plant should be left at the close of the grazing season. Properly used grasses furnish green feed one or two weeks earlier in the spring.

Determining Proper Use

To determine proper use, or the amount of grass stubble to leave, follow these steps:

- Wrap mature ungrazed plant with string.
- Cut off plant at ground level.
- Place wrapped plant across finger and measure from bottom of plant to the point where it balances; the distance is the proper height-use for the grass.
- As a check, cut the plant at the point of balance; the parts should be equal in weight.

Ideally, half the growth of palatable plants on a range should be utilized. The other half, called carry-over, is not wasted. It is left as a necessary litter and for maintenance of the plants and the site.

Adjust the grazing load on the range to the weather. Aim at proper use of the whole area. Make utilization checks on climax plants. Keep the livestock operation flexible to withstand any and all adverse weather.

You can keep your livestock operation flexible by:

- Grazing 75% of year-long recommended stocking rate with breeding animals, which allows the range to make feed reserves.
- Buying dry animals or keeping back young animals when there is range forage that cannot be utilized.
- Building feed and cash reserves during good years to withstand bad years.

5. GOOD MANAGEMENT PRACTICES

Good range practices increase the amount of usable range forage, replace plants that produce poorly with good ones, conserve soil and water and increase the value of your range.

IMPROVING THE WATER SUPPLY

On most western ranges, the water supply is inadequate for the number of stock the range can carry. Even when forage is abundant, livestock must have all the water they can drink. They should not have to travel far for water. If you provide enough watering places, your cattle will not overgraze one area and neglect the rest of the range. Poor use of range forage leads to poor gains on stock.

If there is already plenty of water on the range and the feed is evenly used, new water developments are not necessary.

Water Needs of Stock

The amount of water needed by stock differs with the kind of range, the amount of salt consumed, the climate, the season and the kind of stock. On the average, cattle need 45 litres (10 gallons) and sheep 4.5 litres of water per day.

Cattle like to drink daily during the hot summer period. They normally drink every two days in winter. Sheep can go without water for two or three days or longer, depending upon the temperature, the frequency of showers or dew and the amount of moisture in the grazed forage.

Watering places should be closer together in mountainous country than on the plains. In steep mountain country, cattle should not have to travel more than 0.75 kilometre for water and sheep not more than 2.5 kilometres. In the plains country, cattle can travel 2.5 kilometres and sheep 5.0 kilometres, but the shorter the distance the better for the animal. There should be one watering place per section for best distribution of grazing.

Additional Watering Developments

It pays to develop additional stock water when it is needed. You may get a greater amount of beef or lamb per section. Develop springs or seeps that you are sure will furnish a dependable supply of clean, wholesome water through the grazing season. Try to make dangerous bog holes into good watering places.

Springs. To develop a good watering place from a spring, clean the soil away from the spring down to bedrock, if practical. Build a concrete or masonry box around the source of the water with an outlet pipe several centimetres above the bottom. A close-fitting wooden or rock lid keeps out the dirt.

Run the outlet pipe to a trough or tank. Provide the tank with an overflow that will deliver the extra water far enough away from the trough to prevent mud holes or ice sheets from forming near the tank. Unused tanks may be drained in winter.

Wells. Wells and windmills are used where good reservoir sites or natural springs are not available. Well drilling is usually contracted to an experienced person with a good reputation and good equipment for the work.

Advantages of wells for stock water are that they:

- Can be drilled near the forage supply.
- Furnish a more dependable supply in a dry season or in winter.
- Provide the livestock with a safe watering place in winter.

Troughs at wells and windmills should be about 40 centimetres deep for cattle and 20 to 25 centimetres for sheep.

Fig. 14 Stock watering from a well.

Reservoirs. Reservoirs may provide the cheapest supply of water. Build them where drainage is good. Talk with Prairie Farm Rehabilitation Administration engineers or your District Agriculturist regarding possible locations and design of your reservoirs. Soil type is important — reservoirs built on sandy soil are of little value if they cannot be made to hold water. Treating reservoir bottoms with bentonite clay, salt or plastic liners may help to seal leaks.

Check carefully regarding the legal specifications and water rights with the Water Resources Branch, Alberta Department of Environment.

Dams. In building dams, spillway design is especially important. A good rule is to make the spillway low enough to allow water to flow through when it gets within one metre of the top of the dam. Have the spillway wide enough and deep enough to allow the water to pass through it in a thin, solid sheet that will not erode the soil.

BUILDING FENCES

Here are good reasons why you should have good fences on the range. Fences:

- Help to prevent trespass by stray stock.
- Help to distribute livestock and prevent drifting.
- Make deferred and rotational grazing possible.
- Make it possible to isolate problem areas or reseeded areas.
- Make it possible to separate different classes of stock.

Barbed wire, which was invented about 1873 and became popular around 1880, is the most common fencing material. Three-wire fences with wooded posts are widely used for cattle and horses, while woven wire fences are usually required for sheep.

Electric fences may be a single strand of barbed wire or two strands of high tensile wire on widely separated posts, or polywire on fiberglass posts. They are useful for temporary purposes but are not considered effective for sheep. Suspension fences, of three barbed wires on posts 50 metres apart, are used on level terrain. Wires are held apart by twisted wire stays.

Build cross fences to follow natural land features or the lay of the land. Cross fences should be planned so that all pastures have about the same potential stocking rate. When pastures are large and contain different range sites, livestock normally concentrate on the best sites first. When the forage on these sites is depleted, livestock move to the next most desirable one. A valley site is capable of producing several times more forage than a shallow upland or ridgeland site. Study the movement of livestock in pasture for about one year before you actually build the cross fences or drift fences. Do not build fences where they will cause stock to walk farther to feed or to water. Stock like to move "on the level" and in all directions from water. Let them do it.

PROVIDING SALT

Grazing animals need more salt (sodium chloride) than they can get from plants. Lack of salt causes animals to lose their appetites and lose weight, their eyes to become dull and their coats rough. They do not grow as well as they should.

Salt distribution may offer a means of getting an even use of range forage in a pasture. Salt attracts livestock. They will often travel a long way to find it. Watch the cattle when you move salt to a new location to see if they find it. They might need help.

Salt is usually placed in troughs to protect it from wind and rain. On the plains, oil barrels are used with part of the side cut out and folded back to make an awning for the opening. The hole in the barrel must be large enough for a cow or bull with horns to get its head in and out easily.

When you provide salt:

- Allow about one kilogram per cow per month and about 0.25 kilogram per sheep per month.
- Use crushed salt containing stabilized iodine and needed trace minerals. Hard block salt forces animals to lick too long to get enough salt.
- Place salt boxes on knolls, benches, in timber openings or on gentle slopes on underused sites.
- Place salt about one kilometre from water where forage is plentiful.
- Move the salt with the livestock.
- Have one saltground for every 40 or 50 head of cattle.
- Have a salt plan for each pasture.

REGRASSING RANGELAND

An important part of any grazing program is the job of "rounding out" the year-long forage supply. Native range furnishes excellent forage for livestock during the growing season. Native range, especially if it has palatable shrubs on it, is often used in winter. Cured range grasses may lack important nutrients. Livestock miss green grass in their diets in late fall and winter. The green grass season can be lengthened by seeding cropland or suitable range sites to highly productive grasses and legumes.

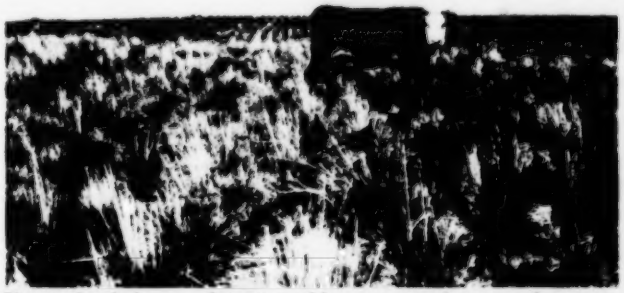


Fig. 15 Seeded range of Russian wildrye grass produces good pasture.

By now, you should have selected varieties that will provide the forage during the period it is most required. A goal to shoot for is *six months of green grass.*

Preparing the Seedbed

Seedbed preparation is the first "hurdle" to get over in regrassing. Seedling plants are weak. They cannot stand competition from large established plants. Therefore, remove all undesirable, moisture-robbing plants from the site to be reseeded. You know that seeded grasses do much better in clean ground, free from other plants.

Till the soil shallowly just before reseeding to kill weeds. Grain stubble is an excellent seedbed, if there is enough moisture available. No tillage is then needed. The seedbed should be very firm. Loose soil is not a food forage seedbed.

How to Seed

A drill with depth regulators is the best tool for seeding. Sprouts of small grass seeds planted too deep will die before they can reach the surface. Neither should seeds be planted too shallow. They need moisture to germinate. Therefore, sow seed into soil that is moist enough to germinate them and shallow enough to let them emerge. Plant the smallest seeds at 0.5 centimetre deep, and the larger seeds at 2.0 centimetres. Plant slightly deeper in sandy soils and shallower in heavy clay or silt soils.

Broadcasting seed, generally, is not a good practice. The seeds are seldom covered uniformly, but it may be the only way to place the seed in rough country.

When to Seed

Time of seeding is important. Fall seeding probably is better than spring seeding, depending on what you are planting. Seedlings must have moisture while they are getting established. The time to seed depends more on the rancher than on the rule.

What to Seed

What to seed depends upon local conditions. Plant grasses that suit your locality. Some grasses do better on heavy, clay soil than on sandy soil, and vice versa. On loam soils, still other grasses may be better suited. Ask your District Agriculturist when and what to plant.

Plant a legume whenever you seed grass. You need only a small amount — from 0.5 to 1.0 kilograms of legume seed per hectare is enough.

Managing Seeded Pasture

Do not graze new seedlings while they are getting established. If grazed too soon, they may be pulled up by the roots, especially if the soil is wet. Seedlings take about one year to become firmly rooted. Even during the second spring, grazing should be moderate. If weeds seem to be getting ahead of the young grass in the first year, clip them. The fallen weeds make good mulch that helps keep the moisture near the surface of the soil. If the seeded area is too rough to mow and the weeds are much higher than the grasses, they might be grazed off if the livestock will eat them.

Relatively large seeded fields with their own water supply should be fenced off from surrounding native range. Fenced fields can be grazed at the time best suited to the seeded plants, which may be a different time than for native plants.

Check the grazing calendar to see how the different pastures might be seeded to make six months of green grass. Adapt the grazing calendar and kinds of grass to your area.

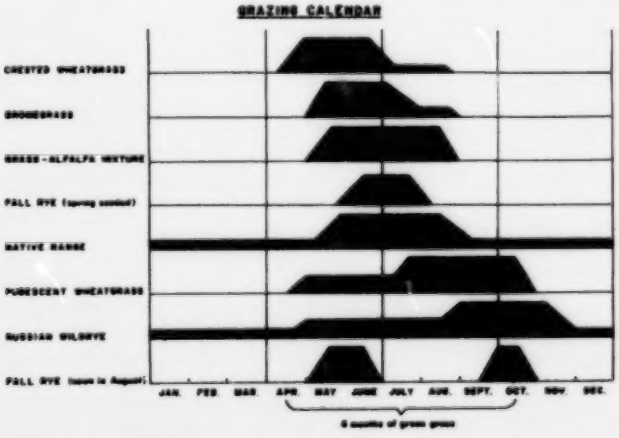


Fig. 16 Grazing calendar — When reseeding, aim for six months of green grass.

CONTROLLING UNDESIRABLE PLANTS

Control of Brush

A certain amount of brush cover on range is desirable. Brush provides shelter for livestock, food and shelter for wildlife and serves to catch and hold winter snowfall. However, since man has controlled wildfires, brush has tended to increase on range, particularly in the foothills and parkland areas. Brush species invade open native grasslands primarily by way of creeping roots. As brush cover expands, grass growth is reduced and the new brush becomes a barrier to grazing.

The presence of useless shrubs or brush on the range lowers production of native grasses (and of livestock). Brush plants use about four times more water than native grasses do during growth.

Fig. 17 Brush removal will result in better grazing and greater forage production.

No one treatment will control brush. Some woody plants possess a reserve of shoot buds and food in their root system from which new sprouts can be produced. The choice of brush control treatments will depend upon soils, topography, brush species to be controlled and the nature of the ranching operation. Generally, more than one treatment should be applied in combination to give cost-effective results. Some of the brush control treatments that may be considered include:

- Chemical methods — herbicides applied either by aircraft or ground machines.
- Mechanical methods — including gyro-mowing and bulldozing.
- Fire — before proceeding you must know when, where and how to burn and you must know fire laws and get needed permits. Conditions must be just right for best results. Normally you would not use fire for brush control without the help of government personnel who are specially trained to use fire.
- Controlled grazing — with proper management, livestock may be used to graze the woody shoots.

Do not graze an area during the first growing season after brush control measures have been applied. Give grasses a chance to become established, although annual forages may be seeded on newly cleared land to provide temporary pasture and to suppress the growth of suckers. Follow-up grazing management should be carefully planned to fit in with the combination of brush control treatments utilized.

Control of Poisonous Plants

You can control poisonous range plants with appropriate chemical herbicides. Care should be taken to prevent pollution of water courses and drifting of the spray mist onto trees or agricultural crops. Do not expose animals to plants sprayed with herbicides. Livestock poisoning has been traced to such plants.

Make sure that good plants take the place of those killed. Reseed and defer grazing as necessary.

Some poisonous species start growing early in the spring, before the good range plants. When this happens, it is wise to defer or delay grazing. Tall larkspur is a poisonous plant that is particularly toxic during spring and early summer. Ranges with large quantities of tall larkspur should be left ungrazed until August when the plants have lost their toxicity.

PLANNING A GRAZING SYSTEM

The four main grazing systems are rotational grazing, deferred grazing, complementary grazing and continuous grazing. Each has its advantages and disadvantages.

In **rotational** grazing, one unit or pasture is grazed, then another, and another, and so on back to the first. The system works well with two, three or more pastures where one pasture receives a rest or several rests in the same year. Short duration grazing, a form of rotational grazing, has aroused interest in Alberta. It emphasizes the importance of timing the grazing and rest periods within a grazing season in order to restore plant vigor.

In **deferred** grazing, the stock are generally kept off an area until after the most important forage plants have made seed. This is a good system to use where range has been heavily grazed and is in poor condition. Rest in the spring is the best "medicine" for a sick range.

In **complementary** grazing, a seeded grass is grazed early in the season, and then the native grass. In one test, grazing of crested wheatgrass in May and June and grazing of native range from July to October resulted in 35% greater carrying capacity compared with continuous grazing of the native range.

Generally, continuous grazing is practised on most ranches in the summer and winter. Winter grazing is less harmful to plants than summer grazing. Stocking rates can be increased considerably if grazing is confined to the winter months.

Whatever the grazing system, it should fit the range unit. Ranchers can get help in planning a good grazing system from their District Agriculturist or range specialist.

6. ROUNDING UP YOUR RANGE MANAGEMENT PLAN

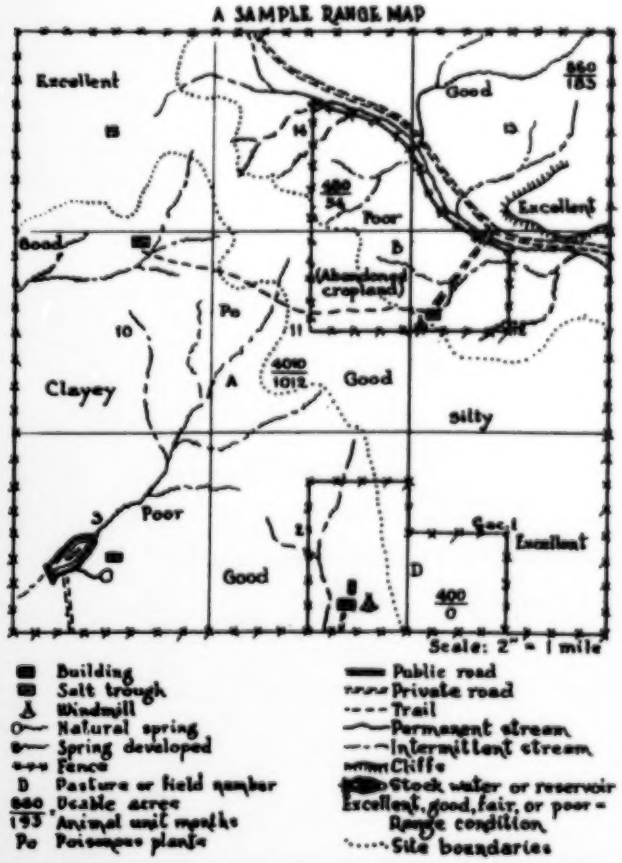
Every good range operator knows what resources are available to work with. You should use a map to keep an inventory of resources. Maps are more accurate than memory. We do not always notice gradual changes. Range grazed by livestock can change so gradually that you may not notice the change. And yet, the change may affect your income from the range, or mean the loss of valuable soil and water.

A map is the most important part of your range plan. It gives you a picture of what you have to work with and what you intend to do with it. The map should show each range site and its condition; artificial features such as fences, trails, watering and salting places and buildings; natural features such as coulees, streams, trees and cutbanks; and anything else that may affect the livestock handling.

A map, such as the one shown here, can be made up on a grid showing the sections, quarters and possibly smaller areas. Aerial photographs are available for all parts of Alberta and can be obtained from the Department of Forestry, Lands and Wildlife in Edmonton. When you inquire about aerial photos, give the legal description of your land. You can transfer most of the features mentioned above from the photos to your map. A little practice with a stereoscope will make you proficient in interpreting features from aerial photographs.

You can base your management practices on what the map shows to be the range condition and forage use in the different areas of each pasture. Your map will show the changes you need to make to get the best production from your land. For instance, a pasture that is in poor condition at one end, but in excellent condition at the other, might indicate the need for cross fencing or for additional watering places nearer the excellent forage. A change in salting practices may be needed to attract the stock to areas in excellent condition. The place where those five steers died may be infested with a poisonous plant! Examine the site on the ground, fence it off and control the infestation as required.

Improvements and changes can be shown on an overlay of tracing paper laid over the original detailed map. You can use overlays on aerial photos too. On the overlay, show the fences to be moved or new ones to be built, new water development, new saltgrounds and any other changes you have made.



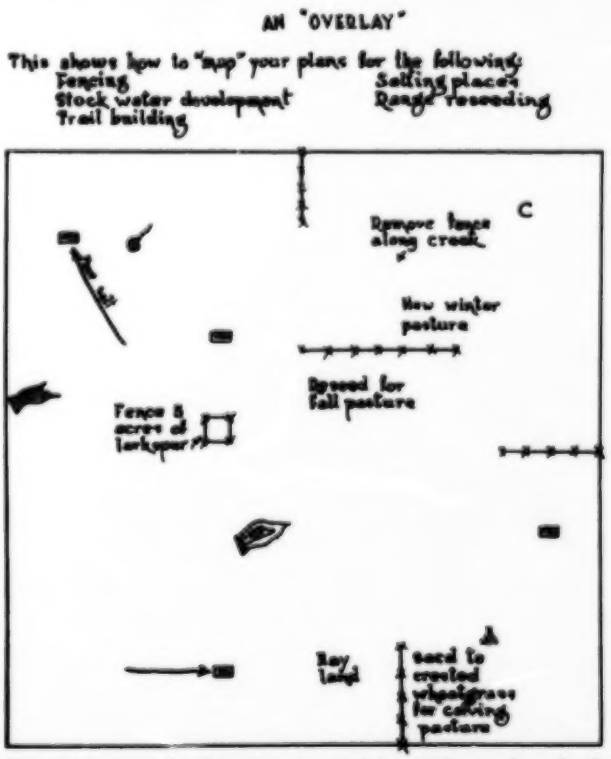


Fig. 18 An example of a range map and the overlay used to plan for range improvements.

Mark problem areas to be treated on the overlay. Abandoned farmland to be seeded to grass, or poisonous plants or shrubs to be controlled, can be marked on the overlay. Show the year during which each of the changes is to be made, either on the overlay or on the written plan, or both.

The example shows how an overlay is used in planning for range improvement. It proposes the following range improvement practices, from north (top) to south:

- Build four new pieces of fence and remove one piece to give better pasture arrangement; add pasture C.
- Reseed area for better calving pasture and fall pastures.
- Develop four possible new stock-watering facilities to get more uniform grazing or forage.
- Move two salt stations and add two new ones to attract stock to the lightly used range areas.
- Fence out poisonous plants.

If you are just starting your range map, you will save time by obtaining plan book sheets from a book store or municipal or county office. Ordinary heavy paper will do very well, if it is tough and light colored. It will need to have grid lines to represent quarter-sections, sections and townships.

Aerial photographs may help you locate important features on your map. It will be practical to use tracing paper to transfer information to your maps from photos if the aerial photos are on the same scale as your maps.

For further information on range management, see your District Agriculturist or range specialist. They will tell you where you can get additional technical help.

APPENDIX

Plant Characteristics for Judging and Identifying Range Plants

Plants included in the following chart were selected on the basis of their importance, distribution and forage contribution for the range areas of Alberta. The common names listed are the standardized plant names. Descriptions of some of the terms used are:

Grasses are plants with hollow, jointed stems and leaves in two rows on the stems. Veins in the leaves are parallel.

Shrubs are woody perennial plants with stems that live over the winter and branch from near the base.

Forbs are broadleaved plants with annual stems (tops). The veins in the leaves are usually, but not always, netlike.

Annuals are plants living only one year.

Biennials are plants living two years.

Perennials are plants surviving from year to year, producing leaves and stems for more than two years from the same crown.

Native plants are those which have always grown in the range area being considered.

Introduced plants are those which have been brought in from outside the range area being considered.

Cool-season plants make their principal growth during the cool weather of late fall and early spring.

Warm-season plants make their principal growth during late spring and early summer and develop seed in the summer or early fall.

Grazing response is the way the amounts of various plants in the range change when they are grazed. Range plants are grouped as decreaser, increaser or invader plants.

Decreaser plants are plentiful in a climax range but are the first to decrease as grazing becomes too heavy. They are the plants best liked by the livestock. The poorer the condition of the range, the fewer decreaser plants there will be.

Increaser plants are also plants of a climax range but they increase in number as grazing becomes heavy. They escape grazing because they are short or because they are less tasty to livestock. They replace decreaser plants that have been weakened by overgrazing.

Invader plants invade and replace the decreaser and increaser group plants as they are removed or seriously weakened by overgrazing. They are not present in climax vegetation or are there only in very small amounts. These plants are the danger signal of a deteriorating range.

Forage value is determined for each species on the basis of palatability, nutritive content and dependability as a forage supply. This is a relative factor and may vary, depending on the kind of livestock, other plants present, the soil fertility and the season. Forages are classed as good, fair or poor.

Poisonous plants contain or produce substances that cause sickness, death, disability, wounds or skin eruptions. These plants are found in range areas but are normally unpalatable and are only eaten in times of drought or in spring and summer when other forages are scarce.

Plant Characteristics for Judging and Identifying Range Plants

Name of Plant	Type of Plant				Life Span			Origin of Plant		Season of Growth		Grazing Response			Forage Value			
	Grass	Grasslike	Shrub	Forb	Annual	Biennial	Perennial	Native	Introduced	Cool	Warm	Decreaser	Increaser	Invader	Good	Fair	Poor	Poisonous
Arrowgrass				•			•	•		•			•				•	•
Balsamroot				•			•	•		•			•			•		
Baltic rush		•					•	•		•			•				•	
Bearded wheatgrass	•						•	•		•		•			•			
Blue grama	•						•	•			•		•		•			
Canada bluegrass	•						•		•	•				•	•			
Canada wildrye	•						•	•		•		•			•			
Canby bluegrass	•						•	•		•		•			•			
Cheatgrass brome	•				•				•	•				•			•	
Common chokecherry			•				•	•			•	•				•		•
Dandelion				•			•		•	•				•			•	
Death camas				•			•	•		•			•				•	•
Foxtail barley	•						•	•		•				•			•	
Fringed sage			•				•	•		•			•				•	
Geranium (sticky)				•			•	•		•		•			•			
Giant wildrye	•						•	•		•		•				•		
Goatsbeard				•		•			•	•				•			•	
Greasewood			•				•	•			•		•			•		•
Green needlegrass	•						•	•		•		•			•			
Gumweed				•		•		•			•		•				•	
Hairy wildrye	•						•	•			•		•			•		
Hoary sagebrush			•				•	•			•		•			•		
Hooker's oatgrass	•						•	•			•	•				•		
Idaho fescue	•						•	•		•			•		•			
Indian ricegrass	•						•	•		•		•			•			
Junegrass	•						•	•		•			•		•			
Kentucky bluegrass	•						•		•	•				•	•			
Little bluestem	•						•	•			•		•				•	
Loco-weed				•			•	•		•			•				•	•
Larkspur				•			•	•		•			•				•	•
Lupine				•			•	•		•			•				•	•
Marsh reed grass	•						•	•		•		•				•		

Plant Characteristics for Judging and Identifying Range Plants

Name of Plant	Type of Plant				Life Span			Origin of Plant		Season of Growth		Grazing Response			Forage Value			
	Grass	Grasslike	Shrub	Forb	Annual	Biennial	Perennial	Native	Introduced	Cool	Warm	Decreaser	Increaser	Invader	Good	Fair	Poor	Poisonous
Mountain brome	•						•	•		•		•			•			
Narrowleaf milkvetch				•			•	•		•			•				•	•
Needle-and-thread	•						•	•		•			•		•			
Northern wheatgrass	•						•	•		•		•			•			
Nuttall's atriplex			•				•	•			•	•			•			
Parry's oatgrass	•						•	•		•			•		•			
Peavine				•			•	•			•	•			•			
Phlox				•			•	•		•			•				•	
Plains muhly	•						•	•		•			•			•		
Prairie sage			•				•	•			•		•			•		
Prairie bulrush		•					•	•		•			•			•		
Prickly rose			•				•	•		•			•				•	
Red-root pigweed				•	•			•			•			•			•	
Rough fescue	•						•	•		•		•			•			
Russian thistle				•	•				•		•			•			•	
Sandberg bluegrass	•						•	•		•			•		•			
Sand grass	•						•	•			•		•			•		
Saskatoon			•				•	•		•		•				•		
Shrubby cinquefoil			•				•	•		•			•				•	
Slender wheatgrass	•						•	•		•		•			•			
Slough grass	•						•	•		•			•			•		
Streambank wheatgrass	•						•	•		•		•			•			
Threadleaf sedge		•					•	•		•			•		•			
Timber oatgrass	•						•	•		•			•		•			
Tufted hairgrass	•						•	•		•		•			•			
Two-grooved milkvetch				•			•	•		•			•				•	•
Vetch				•			•	•			•	•			•			
Western porcupine grass	•						•	•		•		•			•			
Western snowberry			•				•	•		•			•				•	
Western wheatgrass	•						•	•		•			•		•			
Winterfat			•				•	•		•		•			•			
Yarrow				•			•	•		•			•				•	

NOTE: Plant names used are the standardized common names.

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